

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>H05K 7/20</b>	<b>A2</b>	<b>(11) International Publication Number:</b> <b>WO 00/56134</b> <b>(43) International Publication Date:</b> 21 September 2000 (21.09.00)
<b>(21) International Application Number:</b> PCT/US00/04598 <b>(22) International Filing Date:</b> 23 February 2000 (23.02.00)  <b>(30) Priority Data:</b> 09/271,940 18 March 1999 (18.03.99) US  <b>(71)(72) Applicant and Inventor:</b> WRIGHT, Johnathan [US/US]; 4351 North O'Connor Boulevard, Irving, TX 75062 (US).  <b>(74) Agent:</b> LYNCH, David, W.; Altera Law Group, L.L.C., 10749 Bren Road East, Opus 2, Minneapolis, MN 55343 (US).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>Without international search report and to be republished upon receipt of that report.</i>
<b>(54) Title:</b> METHOD AND APPARATUS FOR PROVIDING AIR CIRCULATION CONTROL FOR A BASE TRANSCEIVER STATION		
<b>(57) Abstract</b>  An air circulation control apparatus and method for a system such as a Base Transmission (or Transceiver) System (BTS) provides a control of an ambient air flow between inside and outside of the system. The apparatus includes at least one controller, such as a fan, and a member along an air flow path of the system. The member may be moveably mounted on the inside wall of the system. The controller operates in a forcing mode or a drawing mode to open or close the member so as to allow or not allow the air flow between inside and outside of the system.		

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

## METHOD AND APPARATUS FOR PROVIDING AIR CIRCULATION CONTROL FOR A BASE TRANSCEIVER STATION

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention.

5        This invention relates in general to a Base Transmission (or Transceiver) System or BTS, and more particularly to an air circulation control for the BTS.

#### 2. Description of Related Art.

Air circulation inside a Base Transmission (or Transceiver)

10       System or BTS is vital for the dependability of a product in a hot environment. Accordingly, there is a need for a cooling design in a BTS. Also, under a very cold environment, such as a temperature specification of -33 °C etc., it is required that a BTS be pre-heated before the BTS is activated and that during a normal operation the BTS be heated internally.

15       Generally, the ambient air can enter a system such as a BTS through the following method: fans are turned on, and convection and ambient air flow results in air circulation in the BTS. Prior methods include air/cabinet heaters.

20       It can be seen then that there is a need for an apparatus and method to reduce the ambient air from entering into a system being heated or to prevent hot air from exiting the BTS.

It can also be seen that there is a need for a less expensive and more reliable apparatus and method to control the air conditions in a system, such as a BTS.

It can also be seen that there is a need for an apparatus and method  
5 for minimizing the ambient air entering into a system, increasing the ambient air in the system when the ambient air is needed under cooling conditions, and preventing hot air from exiting the system.

SUMMARY OF THE INVENTION

To overcome the limitations in the prior proposal, and to overcome other limitations that will become apparent upon reading and understanding the present specification, the present invention discloses an air circulation  
5 control apparatus for a system such as a Base Transmission (or Transceiver) System (BTS).

The present invention solves the above-described problems by providing an apparatus and method for controlling the air flow of a system, such as a BTS, depending on the changes in air temperature.

10 In one embodiment, the apparatus in accordance with the principles of the present invention includes: a fan disposed in an internal air flow of a system such as a BTS, and a member for controlling air flow between inside and outside of the system, wherein the position of the member is moved between a first position and a second position by the fan. When the air  
15 temperature is cold, the fan closes the member to stop the air flow between the inside and the outside of the system. When the air temperature is hot, the fan opens the member to allow the air flow between the inside and the outside of the system.

Other embodiments of a apparatus in accordance with the principles  
20 of the present invention may include alternative or optional additional aspects. One such aspect of the present invention is that the fan can be disposed at an air intake of the system. The fan is capable of operating in a drawing mode and a blowing mode. In one embodiment, the apparatus may include a plurality of fans. In one arrangement, a primary fan is used to

open and close the member, and a secondary fan or fans are used to circulate the internal air of the system. In an alternative arrangement, no primary fan is used, and a secondary fan or fans are used to open and close the member as well as to circulate the internal air of the system.

5        Another aspect of the invention is that the member can be moveably connected to the inside walls of the air flow path. In one embodiment, the member is mounted proximate the air intake of the system. The member may also be moveably mounted on the fan.

Another aspect of the present invention is that the air circulation  
10    control apparatus maybe disposed at the air intake or at an exhaust port of a system.

One advantage of the present invention is that no electromechanical motor is required to heat and/or cool the system such as a BTS. Accordingly, the system is much cheaper. Further, the air circulation for the BTS is more  
15    reliable as it does not rely on the operation of an electromechanical motor or their associated mechanical and electrical parts.

These and various other advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and form a part hereof. However, for a better understanding  
20    of the invention, its advantages, and the objects obtained by its use, reference should be made to the drawings which form a further part hereof, and to accompanying descriptive matter, in which there are illustrated and described specific examples of an apparatus in accordance with the invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

Fig. 1 illustrates a schematic view of one embodiment of an air circulation control system for a system such as a BTS when the BTS is in a hot environment, in accordance with the principles of the present invention;

Fig. 2 illustrates a schematic view of one embodiment of an air circulation control system for a system such as a BTS when the BTS is in a cold environment, in accordance with the principles of the present invention;

Fig. 3 illustrates a schematic view of a second embodiment of an air circulation control system for a system such as a BTS when the BTS is in a hot environment, in accordance with the principles of the present invention; and

Fig. 4 illustrates a schematic view of the second embodiment of an air circulation control system for a system such as a BTS when the BTS is in a cold environment, in accordance with the principles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following description of the exemplary embodiment, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration the specific embodiment in which the invention may be practiced. It is to be understood that other embodiments may be utilized as structural changes may be made without departing from the scope of the present invention.

The present invention provides an apparatus and a method for controlling an air flow between inside and outside of a system, such as a Base Transmission (or Transceiver) System or BTS, within a hot or cold environment. The present invention used in a BTS is discussed in details below. It is appreciated that the BTS is one exemplary application of the present invention, and that many other applications can be used without departing from the principles of the present invention.

Referring now to Fig. 1, an air circulation control apparatus in a BTS is illustrated. The apparatus includes a controller 22 for controlling a member 26 to allow air flow within the BTS 20. The controller 22 is preferably a fan. Hereinafter, for clarity, the controller 22 will be described as being a fan. However, those skilled in the art will recognize that the present invention is not meant to be limited to using a fan to control the position of the member 26 for allowing air flow within the system 20.

For example, as shown in Fig. 1, a fan 22 may be located at an air intake 24 of the BTS 20. A member 26 is moveably mounted on the inside walls of an air flow path or duct 28 indicated by arrows. The connection



between the member 26 and the inside walls of the air flow path 28 can be any conventional means, such as a hinge 29, etc. The member 26 may also be moveably mounted on the outside of the primary fan 22. Further, those skilled in the art will recognize that the member 26 may operate via the force  
5 of gravity, a spring mechanism, etc. to bias the member in an open or closed position. Those skilled in the art will recognize that the examples described with the drawings herein show the member 26 biased in a closed position. However, it will also be appreciated that the member 26 may be biased in an opened position with corresponding alteration in the operation of the fan  
10 (controller) 22.

When the member 26 is in an open position, the ambient air is allowed to flow into the air flow path 28 of the system. When the member 26 is in a close position, the ambient air is not allowed to flow into the system. The primary fan 22 can be operated in a drawing mode (as best seen in Fig.  
15 2) and a blowing/forcing mode (as best seen in Fig. 1) to control the opening and closing of the member 26. When the primary fan 22 is in a drawing mode as shown in Fig. 2, the fan draws air from the air flow path (moves air current inward in a positive mode). The member 26 is forced to close the air flow path 28. In this situation, ambient air is not allowed to enter into the  
20 BTS. This is especially useful in a cold temperature when the BTS is required to be preheated before activation. Those skilled in the art will recognize that the air flow path may be at an air intake port or at an air exhaust port.

On the other hand, when the primary fan 22 is in a blowing mode, the fan blows air into the air flow path (moves air current outward in a negative mode). . The member 26 is forced to open the air flow path. In this situation, ambient air is allowed to enter into the BTS. This is especially  
5 useful in a hot temperature when the BTS is required to be cooled. It is appreciated that the primary fan may be adjusted to open the member at an angle between a full close position and a full open position depending on the desired temperature specification.

Also in Figs. 1 and 2, the air circulation control apparatus also  
10 includes a plurality of secondary fans 30 disposed inside the BTS for internal air circulation and/or cooling. In Fig. 1, hot air can be blown out via an air outlet 32 of the BTS. The secondary fans 30 are arranged in an array-like manner as shown. It is appreciated that the arrangement of the primary fan and the secondary fans can be varied within the scope of the present  
15 invention. In Fig. 2, the secondary fans are switched off.

Figs. 3 and 4 illustrate another embodiment of the air circulation control apparatus and method wherein no primary fan is used, and only a plurality of secondary fans 30 are used. In Fig. 3, the BTS is under a hot air temperature. The secondary fans 30 draw ambient air into the air flow path  
20 28 such that the member 26 is open. The ambient air is allowed to enter into the path, and the hot air is blown out via the air outlet 32 of the BTS. In Fig. 4, the BTS is under a cold air temperature. The secondary fans 30 blow air from the air flow path 28 such that the member 26 is closed. No ambient air is allowed to enter into the path.

The BTS may include a filter 34 proximate the air intake 24 to filter the ambient air.

It is appreciated that other arrangements and configurations for the fans can be used within the scope of the present invention. For example, the apparatus may include only one primary fan or one secondary fan, and a fan may be disposed at any position within the air flow path.

It is also appreciated that more than one member can be mounted along the air flow path.

It is further appreciated that the air circulation control apparatus can be used in other applications such as an engine compartment, or a generator enclosure, etc. in which an air flow path is defined.

The foregoing description of the exemplary embodiment of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not with this detailed description, but rather by the claims appended hereto.

## WHAT IS CLAIMED IS:

- 1           1.     An air circulation control apparatus for a system having an air  
2     flow path, comprising:  
3           a member, moveably mounted along an air flow path, the member  
4     controlling air flow within the system; and  
5           a controller, disposed in the air flow path of the system, for controlling  
6     a position of the member to maintain a predetermined temperature range  
7     within the system.
- 1           2.     The air circulation control apparatus of claim 1, wherein the  
2     controller is capable of closing the member to stop air flow between inside  
3     and outside of the system and is capable of opening the member to allow air  
4     flow between inside and outside of the system.
- 1           3.     The air circulation control apparatus of claim 1, wherein the air  
2     flow path comprises an air intake port.
- 1           4.     The air circulation control apparatus of claim 1, wherein the air  
2     flow path comprises an exhaust port.

1           5.     An air circulation control apparatus for a Base Transmission  
2     (or Transceiver) System (BTS), comprising:  
3           a primary controller, disposed at an air flow path of the BTS, the  
4     primary controller operating to produce an inward current of air for a positive  
5     mode and outward current of air for a negative mode;  
6           a plurality of secondary controller inside the BTS operating to  
7     produce an inward current of air for a positive mode and outward current of  
8     air for a negative mode; and  
9           a member being controlled by the primary controller to initiate and  
10    terminate the inward and outward air current.

1           6.     The air circulation control apparatus of claim 5, wherein the  
2     primary controller forces ambient air into the BTS to open the member, and  
3     the primary fan draws the ambient air out of the BTS to close the member.

1           7.     The air circulation control apparatus of claim 5, wherein the  
2     member is moveably mounted on inside walls of the BTS.

1           8.     The air circulation control apparatus of claim 5, wherein the air  
2     flow path comprises an air intake port.

1           9.     The air circulation control apparatus of claim 5, wherein the air  
2     flow path comprises an exhaust port.

1           10.    An air circulation control apparatus for a Base Transmission  
2   (or Transceiver) System, BTS, comprising:  
3           at least one controller, disposed inside of the BTS, being capable of  
4   operating in a drawing mode and a forcing mode; and  
5           a member being controlled by the at least one controller to open and  
6   close air flow between inside and outside of the BTS.

1           11.    The air circulation control apparatus of claim 10, wherein the at  
2   least one controller draws ambient air into the BTS to open the member and  
3   forces the ambient air out of the BTS to close the member.

1           12.    The air circulation control apparatus of claim 10, wherein the  
2   member is moveably mounted on inside walls of the BTS.

1           13.    The air circulation control apparatus of claim 10, wherein the  
2   controller is disposed at an air intake port.

1           14.    The air circulation control apparatus of claim 10, wherein the  
2   controller is disposed at an exhaust port.

1           15.    A method of controlling air circulation for a system having an  
2   air flow path, comprising:

3           operating a controller disposed in the air flow path in a first mode to  
4   close a member, the closing of the member preventing ambient air from  
5   entering the system; and

6           operating the controller in a second mode to open the member, the  
7   opening of the member allowing ambient air to enter the system.

1           16.    A method of controlling air circulation for a Base Transceiver  
2   Station (BTS) having an air flow path, comprising:

3           operating a controller disposed at an air intake of the BTS in a  
4   drawing mode to close a member, the closing of the member preventing  
5   ambient air from entering the BTS; and

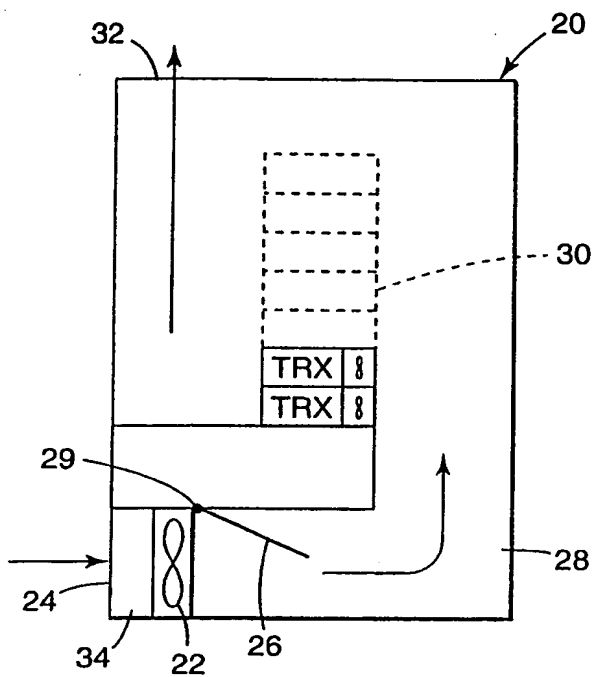
6           operating the controller in a forcing mode to open the member, the  
7   opening of the member allowing ambient air to enter the BTS.

1           17.    A method of controlling air circulation for a Base Transceiver  
2   Station (BTS), comprising:

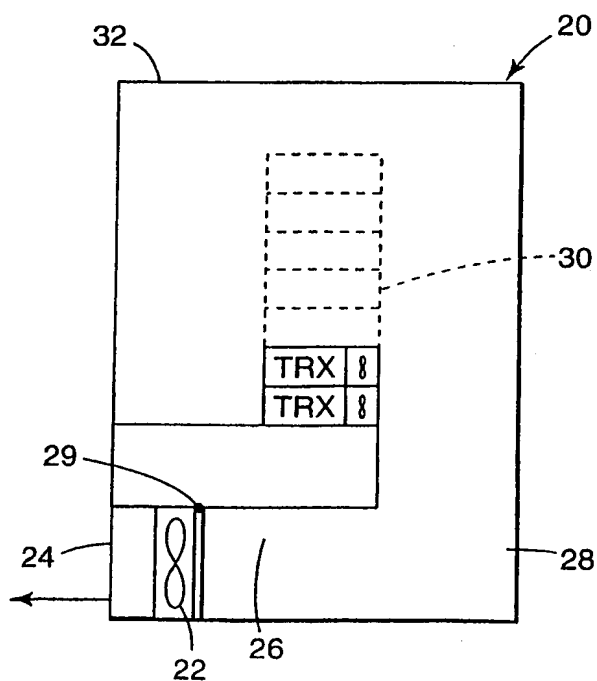
3           operating at least one controller disposed inside of the BTS in a  
4   drawing mode to open a member, the opening of the member allowing  
5   ambient air to enter the BTS; and

6           operating the at least one controller in a forcing mode to close the  
7   member, the closing of the member preventing ambient air from entering the  
8   BTS.

1/2



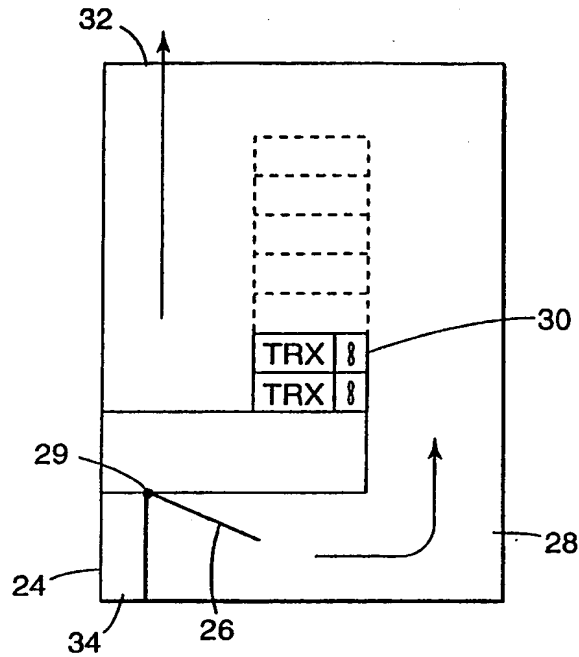
*Fig. 1*



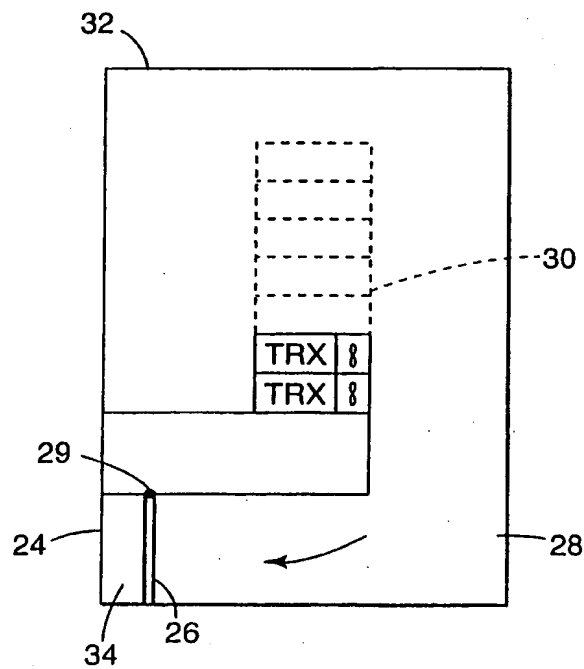
*Fig. 2*



2/2



*Fig. 3*



*Fig. 4*

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
21 September 2000 (21.09.2000)

PCT

(10) International Publication Number  
**WO 00/56134 A3**

(51) International Patent Classification<sup>7</sup>: **H05K 7/20**

(21) International Application Number: **PCT/US00/04598**

(22) International Filing Date: **23 February 2000 (23.02.2000)**

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:  
09/271,940 18 March 1999 (18.03.1999) **US**

(71) Applicant and

(72) Inventor: **WRIGHT, Johnathan [US/US]; 4351 North O'Connor Boulevard, Irving, TX 75062 (US).**

(74) Agent: **LYNCH, David, W.; Altera Law Group, L.L.C., 10749 Bren Road East, Opus 2, Minneapolis, MN 55343 (US).**

(81) Designated States (*national*): **AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.**

(84) Designated States (*regional*): **ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).**

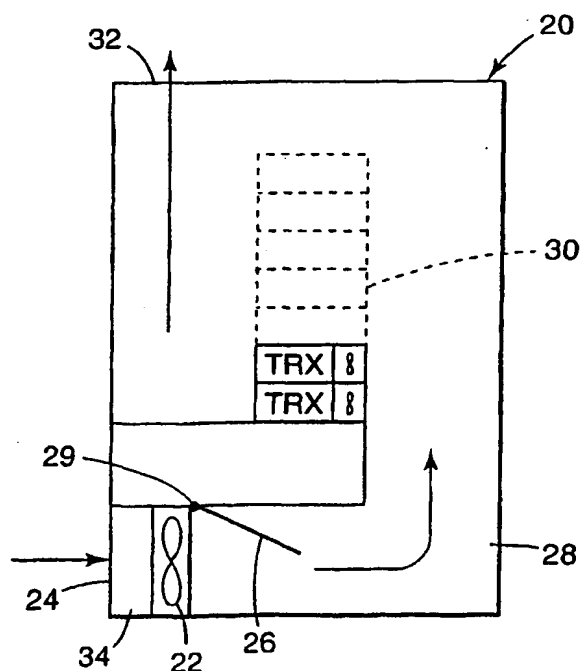
Published:

— *With international search report.*

(88) Date of publication of the international search report:  
**1 February 2001**

*[Continued on next page]*

(54) Title: **METHOD AND APPARATUS FOR PROVIDING AIR CIRCULATION CONTROL FOR A BASE TRANSCEIVER STATION**



(57) Abstract: An air circulation control apparatus and method for a system such as a Base Transmission (or Transceiver) System (BTS) provides a control of an ambient air flow between inside and outside of the system. The apparatus includes at least one controller (22), such as a fan, and a member (26) along an air flow path of the system. The member (26) may be moveably mounted on the inside wall of the system. The controller (22) operates in a forcing mode or a drawing mode to open or close the member so as to allow or not allow the air flow between inside and outside of the system.

WO 00/56134 A3

**WO 00/56134 A3**



---

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/04598

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H05K7/20

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 004, no. 090 (P-017), 27 June 1980 (1980-06-27) & JP 55 052112 A (MITSUBISHI ELECTRIC CORP), 16 April 1980 (1980-04-16) abstract	1-17
X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 07, 31 July 1997 (1997-07-31) & JP 09 083167 A (FUJITSU LTD), 28 March 1997 (1997-03-28) abstract --- -/--	1-17

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

19 July 2000

Date of mailing of the international search report

19.10.00

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Mesa-Pascasio

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/04598

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>PATENT ABSTRACTS OF JAPAN  vol. 1998, no. 14,  31 December 1998 (1998-12-31)  &amp; JP 10 247793 A (DENSO CORP),  14 September 1998 (1998-09-14)  abstract  -----</p>	<p>1,2,5-7,  10-12</p>

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/04598

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 55052112 A	16-04-1980	NONE	
JP 09083167 A	28-03-1997	NONE	
JP 10247793 A	14-09-1998	NONE	